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FINAL REPORT FOR

"MID-IR SPECTROSCOPY OF MERCURY'S SURFACE TO IDENTIFY SURFACE COMPOSITION"

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Two successful flights on the Kuiper Airborne Observatory (KAO) to observe Mercury in the mid-infrared with the High Efficiency Faint Object Grating Spectrograph were made in 1995. Over 100 high quality spectra were obtained between 5 and 14 μm , a spectral region useful for remotely determining the surface composition of airless bodies. These data have been partially reduced and analysed. Two papers have been presented at professional meetings and one more is scheduled for October at a special session on remote sensing of planetary surfaces. These are listed in the brief bibliography at the end of this report. A larger, more comprehensive paper is now underway. We have made good progress toward producing a thermal model of Mercury that can be easily adapted to the observing configuration and geometry of the KAO flights. A graduate student (Josh Emery) in the Department of Planetary Sciences at The University of Arizona is working along with Dr. Josh Colwell, Meudon, under my guidance to complete this project. He has completed the first step of producing an integrated intensity profile that matches the thermal curve of the KAO data from both flights. Each flight was scheduled to observe a different side of the illuminated planet; there were also differences in phase angle, distance to the sun. These phenomena affect the thermal emission of the planet and necessitate a unique application of the Emery and Colwell model.

Three important results from these observations are obvious so far. 1. The large aperture subtended the entire Earth-facing disk and resulting in a blending of many temperatures, and possibly many compositions in the integrated radiance from the planet. The result is a rather low spectral contrast spectrum without the many spectral features seen in ground-based data obtained with a small aperture. 2. We see an excess of thermal emission at 5 μm , even after correction with the Emery and Colwell model, and 3. We see a small feature near 6 μm that may be a feature of plagioclase feldspar. Modeling and further study are required to determine the uniqueness of this result.

Sprague and Witteborn have been examining the data while Sprague seeks to find good terrestrial analogs in the rather small data base available for comparative spectroscopy of planetary surfaces.

FINAL REPORT, CONTINUED

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Bibliography:

Mid-Infrared Spectroscopy of Mercury from the Kuiper Airborne Observatory.

A. L. Sprague, F.C. Witteborn, R.W. H. Kozlowski and D.H. Wooden

March, 21, 1996 Lunar and Planetary Science Conference, Houston, TX

Mid-infrared spectroscopy to determine surface composition of airless bodies.

A. L. Sprague, F.C. Witteborn, R.W.

to be presented October 28, Geological Society of America, Denver, CO

Mercury: thermal emission measurements from the Kuiper Airborne Observatory.

A. L. Sprague, F.C. Witteborn, R.W.H. Kozlowski, and D.H. Wooden. In progress for submission to ICARUS.